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DISTRICT HEATING ASSESSMENT SURVEY FOR THE COMMONWEALTH OF PENNSYLVANIA

Prepared for:

THE GOVERNOR'S ENERGY COUNCIL

By:

BURNS AND ROE COMPANY

SEPTEMBER 1986

DISTRICT HEATING

IN

PENNSYLVANIA

- o Present
- o Past
- o Potential

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1.0 SUMMARY

The purpose of this survey was to investigate the status of district heating in Pennsylvania and make recommendations to the Governor's Energy Council on how to develop a district heating program as a means of conserving energy resources.

The work was performed in the five tasks summarized in the following paragraphs.

Task A. Identification and Evaluation of Operating District Heating Systems

Information was gathered on the operation, maintenance, repair, general history, and future prospects of each operating district heating system in Pennsylvania by means of questionnaires sent to the owners. Seven systems ranging in age from 19 to 98 years were identified. All use steam as the heating medium.

Because of reductions in heat load and an increase distribution piping leaks in the Harrisburg system, operating costs have increased considerably. Proposed installation of cogeneration units and repair of the leaky pipes along with preventive maintenance procedures, should decrease costs sufficiently to attract new customers.

The Philadelphia system, which cogenerates electricity and steam, appears to be in good mechanical and economic condition.

One Pittsburgh (Equitable Gas) system has expanded steadily and, with good maintenance, should be useful for many years. Another Pittsburgh (PACT) system has had stable loads and is also in good condition.

In the Scranton system, customer load is stable. A new study explores all aspects of the system and may lead to improvements.

The Wilkes-Barre system has experienced major withdrawals of customers in the last decade. Hopes for making it competitive are based on the success of a new coal burning, fludized bed boiler.

A system in Erie burns coal and cogenerates electricity and steam. However, the generating station is deteriorating, and there is an ash disposal problem. A life extension study being performed may reveal solutions to these and other problems.

Task A also included an energy assessment of the Capitol Complex in Harrisburg, which utilizes steam from the Harrisburg district heating system. This study is published in a separate volume .

Task B. Identification and Evaluation of Former District Heating Sites

All abandoned district heating systems in Pennsylvania were identified, and the reasons for abondonment were investigated. Identification of old sites was obtained from various sources, and questionnaires were sent to the municipal authorities in the 26 sites affected. Ten replies were received, and information about six other sites was gleaned elsewhere. Little information was available on most systems, many of which were very old. Distribution piping appeared to be the main cause of failure. None of the systems seem capable of reactivation.

Task C. Identification and Evaluation of Prospective District Heating Sites

In this major task, potential sites for district heating were first identified from statistics of populations, winter design temperatures, and heating degree days. Thirty-nine sites were selected as possibilities, and questionnaires were sent to them. Of the 39, responses were received from 17. Relevant data from the questionnaires was used to rank the sites as good, fair, or poor in relation to their potential for district heating. Aliquippa, Altoona, Chester, Easton, Hazelton, Lebanon, New Castle, and Sharon appear to have the heat load and interest necessary to support a district heating system.

Task D. Recommendations for District Heating Incentives

Based on the information derived from Task A, B, and C, and on a study of other district heating programs, recommendations are made for promotion of such programs in Pennsylvania. They include a committee to facilitate implementation of district heating, a budget for funding necessary programs, and financial incentives for construction projects.

Task E. Development of District Heating Community Planning Guidebook

The guidebook produced as an aid for local officials in determining the feasibility of a district heating system is published in a separate volume.

2.0 OPERATING DISTRICT HEATING SYSTEMS IN PENNSYLVANIA

2.1 INTRODUCTION

Information was gathered on the operation, maintenance, repair, general history and future prospects for each operating district heating system in Pennsylvania. The present and possible future conditions of the systems were evaluated, and requirements for improving the systems were identified.

2.2 SURVEY

2.2.1 Procedure

Seven operating systems were identified:

- o Harrisburg (Harrisburg Steam Works)
- o Erie (Penn Electric)
- o Philadelphia (Philadelphia Electric)
- o Pittsburgh (Equitable Gas)
- o Pittsburgh (PACT)
- o Scranton (Community Central Energy Corp.)
- o Wilkes-Barre (Steam Heat Authority)

Questionnaires requesting information on the operation, maintenance, repair and potential projects related to systems were sent to the owners.

2.2.2 Results

Information supplied for each of the seven sites is contained in subsequent subsections under the following headings:

- Site Description
- Operating Data
- System History
- Maintenance
- Repair
- Potential Projects

Data on each site is also contained at the end of this section.

2.2.2.1 HARRISBURG [1,2,3,4]

Site Description - Harrisburg Steam Works Ltd., owns the system which operates from the Walnut Street Steam Heat Plant. The working staff consists of 5 management personnel, 11 operators, 22 maintenance and field personnel, and 4 office workers.

Operating Data - System capacity is 500,000 lb/hr of steam, although only about 300,000 lb/hr are ever consumed. Steam is generated by one coal-stoker-converted-to-oil boiler rated at 80,000 lb/hr and three oil fired package-type boilers each rated 140,000 lb/hr. Plant operating efficiency is 81.5%. No. 6 residual oil is delivered to two truck unloading stations and pumped into two storage tanks of 980,000 gal. each. Cost of oil is $0.7098/gal. Oil is delivered at approximately 140°F, stored at 100°F, heated at the tank outlets to 120°F, and pumped to a heater set where it is heated to 175°F for burning. Propane gas is used for ignition and steam for atomization of oil in the burners.

All steam leaves the plant at 150 psig. Some customers are served at 90 psig and others at about 30 psig. There are five reducing stations beneath city streets. There are over 11,000 ft of high pressure mains from 20 to 4 in. in diameter and 25,000 ft of low pressure mains from 16 to 2 in. in diameter.

There are 600 meters installed on customer property. System personnel overhaul each meter annually, make repairs to the distribution system, read meters, and try to collect delinquent bills.

The following types of buildings are serviced:

Type of Building	Quantity
Office	350
Industrial	2
Shopping center	1
Storage	1
Library	1
Parking	2
School	1
Post office	1
Hotel	2
Residential	200
Government	15

Numerous residential customers present problems because of their small loads.

System History - The Walnut Street Plant was built in 1848 along the former Pennsylvania Canal to operate as a hydro-project. When the canal went out of business in 1901, hand fired anthracite boilers and steam driven turbine generators were installed. After many changes, total capacity reached 1750 kW in 1928.

The Steam Heat Company was organized in 1886 and a steam plant (since razed) was built. In 1912, the plant site was sold to the State, and the Steam Heat Company was sold to the then Harrisburg Light Heat and Power Company. Exhaust steam from the turbine generators at Walnut Street then supplied most of the energy to the steam distribution system. Later, electricity generation was discontinued, and Walnut Street became strictly a steam heat plant.

Between 1950 and 1983, the district heating system had a net load reduction of 101,500 lb/hr (Table 2-1), equivalent to 20% of the total heat capacity of the system. Although the number of customers added were more than the number of customers leaving the system, their heat load was very low. Several customers with high heat loads withdrew during the 1980's; no customers were added.

In 1972, three new oil fired boilers, each with a capacity of 140,000 lb/hr steam, were added to the system, and one anthracite stoker boiler, with a capacity of 80,000 lb/hr steam, was converted to oil. Seven coal stoker boilers, with a total capacity of 380,000 lb/hr, were retired. Cost of conversion was $3,500,000.

Maintenance - Manholes are pumped and traps checked after heavy rain to reduce heat loss and corrosion. Other maintenance procedures are:

Maintenance Procedure	Frequency	No. of Laborers	Involved (days)	Labor Rate ($/hr)
Annual boiler inspection	1/yr	4	30	$14
Change & test cust. meters	550/yr	6	75	11
Check st. PRV's (5 vaults)	2/yr ea	6	12	15
Pump manholes & check traps	After rain	3	2-3	13

Repair - There have been no system failures of more than one block, except those during a flood in 1972. Failures of less than one block were not reported. Most of the piping is enclosed in concrete. As a result, the time required to repair each leak (about 85/yr) is about 5 days for crew of 4 to 6 laborers.

Potential Projects - The owners plan to convert the steam-only system to cogeneration burning 85% natural gas and 15% No. 2 oil. They do not plan to convert from steam to hot water, citing the high cost of street cutting permits and stringent regulations for laying pipe.

Harrisburg Hospital still has connections to the system and could be reconnected easily. The hospital might be reacquired as a customer if the price of steam was right.

A good pipeline along the railroad may be used again if a load is found in that direction. However, the Farm Show Arena, within reach of this line, recently had its heating system redone, making the connection unlikely.

Expansion potential exists to City Towers, the Presbyterian, TRW and B'nai B'rith buildings based on the existence of steam mains in the areas. A review of tne present building heating systems would indicate the likelihood of these possibilities.

TABLE 2-1

CUSTOMER CHANGES IN
HARRISBURG STEAM DISTRIBUTION SYSTEM 1950-1983

Year	Duration of Project	Length of Piping (ft)	No. of Customers	Heat Load (lb/hr)	Cost of Project
			ADDITIONS		
1950	1 mo	126	1 Parkway Apt.	500	$ 5,600
1952	2 yr	435	1 Lab & Ind Bldg.	20,000	12,000
1955	2 mo	170	1 H & Welfare Bldg.	9,000	11,500
1960	2 mo	60	1 Mus. & Arch. Bldg.	14,000	8,000
1961	1 mo	12	1 Post Office	2,000	4,000
1964	1 mo	41	1 Holiday Inn	6,000	11,500
1966	1 mo	20	1 Trans. & Safety Bldg.	16,000	8,000
1977	---	---	1 Strawberry Square	20,000	63,000
			WITHDRAWALS		
1950	1983	Customer owned	1 Conrail	65,000	--
1972	1983	Still in service	1 Hbg. Steel	102,000	--
1975	1980	Negligible	200 Redevelopment	22,000	--

Maintenance Procedure	Frequency	No. of Laborers	Time Involved (days)	Average Labor Rate ($/hr)
Annual boiler inspection	1/yr	4	30	$14
Change & test cust. meters	550/yr	6	75	11
Check st. PRV's (5 vaults)	2/yr ea	6	12	15
Pump manholes & check traps	After rain	3	2-3	13

Repair - There have been no system failures of more than one block, except those during a flood in 1972. Failures of less than one block were not reported. Most of the piping is enclosed in concrete. As a result, the time required to repair each leak (about 85/yr) is about 5 days for crew of 4 to 6 laborers.

Potential Projects - The owners plan to convert the steam-only system to cogeneration burning 85% natural gas and 15% No. 2 oil. They do not plan to convert from steam to hot water, citing the high cost of street cutting permits and stringent regulations for laying pipe.

Harrisburg Hospital still has connections to the system and could be reconnected easily. The hospital might be reacquired as a customer if the price of steam was right.

A good pipeline along the railroad may be used again if a load is found in that direction. However, the Farm Show Arena, within reach of this line, recently had its heating system redone, making the connection unlikely.

Expansion potential exists to City Towers, the Presbyterian, TRW and B'nai B'rith buildings based on the existence of steam mains in the areas. A review of the present building heating systems would indicate the likelihood of these possibilities.

2.2.2.2 ERIE [5]

Site Description - Owner and operator is the Pennsylvania Electric Company. Willard Stinson is the contact for plant records.

Operating Data - The system can supply 400,000 lb/hr of steam at 400°F. Steam is produced in four boilers fired by bituminous coal purchased at $43/ton. The plant cogenerates, producing an electrical output of 118 MWe. Plant efficiency is approximately 80%.

The generating station is old and deteriorating. It experiences emission and ash disposal problems that might necessitate a fuel conversion. The owner is interested in selling the system to Hammond Hospital or a private organization. The following types of buildings are serviced:

Type of Building	Quantity
Office	48
Industrial	2
Storage	0
Library	0
School	21
Post office	1
Hospital	2
Hotel	4
Residential	30
Government	3
Other	46

System History - The system began operation in 1942. Between 1980 and 1985, the number of customers decreased from 212 to 157, mainly due to the increased cost competitiveness of natural gas. Repair of the deteriorating plant will necessitate a rate increase which is expected to cause withdrawal of more customers.

Maintenance - Maintenance information was not provided.

Repairs - Repair information was not provided.

Potential Projects - The owner is performing a plant life extension study. No new projects are planned.

2.2.2.3 PHILADELPHIA [5]

Site Description - Philadelphia Electric Company owns and operates a steam heating system in the center and western areas of Philadelphia. Contacts are Henry J. Wylie and Harry C. Cartledge. The system working staff and functions are:

Superintendent	Overall supervision
Assistant superintendent	Assistant to superintendent
Plant engineer	Direct plant maintenance and budgeting
Supervisory engineer, Schuylkill Sta.	Supervise technical staff
Supervisory engineer, steam heat	Supervise plant technical staff and budgeting
Technical staff, Schuylkill Station	4 engineers and 8 technical assistants

Technical staff, steam heat	4 technical assistants
Operating force, Schuylkill Station	100 operators
Operating force, Steam Heat	25 operators, 13 line and 5 meter people
Maintenance force, Schuylkill Station	35 men of various trades
Maintenance force, steam heat	8 men of various trades
PECo business services division	Provide services to electric and steam customers
PECo mechanical engineer division	Provide engineering expertise

Operating Data - Nine oil-fired boilers in two separate plants produce up to 2,000,000 lb/hr of steam for the system. Cost of No. 6 oil is $0.6697/gal. Operating efficiencies for boilers 23, 24, 26 are 84.6%, 84.6%, 87.3% respectively.

System History - Although no data was supplied on addition and withdrawal of customers, information on boiler additions offers some idea on the expansion of the heating system. In in 1927, the Wilson Steam Plant was built with a capacity of 321,000 lb/hr of steam; in 1937, the Schuylkill Station was built, adding 1,010,000 lb/hr. In 1947 and 1955 expansion of Wilson added 290,000 and 145,000 lb/hr. The Edison Steam Plant was built in 1958, increasing the availability of steam by 360,000 lb/hr. Schuylkill added 180,000 lb/hr in 1967, 180,000 lb/hr in 1968 and 550,000 lb/hr in 1972. Edison added 220,000 lb/hr in 1969 and 220,000 lb/hr in 1971. Presently, Wilson is moth-balled. Although Schuylkill has a total capacity of 1,920,000 lb/hr, only 1,200,000 lb/hr are available due to limitations of the feedwater demineralizing plant. With the Schuylkill 1,200,000 lb/hr and Edison 800,000 lb/hr, the present capacity is 2,000,000 lb/hr, more than five times the capacity in 1927.

Maintenance - Boilers and related equipment are inspected yearly.

Repair - Various major and minor failures have occurred over the life of the system. Apparently some were material failures; all major failures were the result of operator errors.

Potential Projects - No major new projects are planned. An investigation into the possibility of installing culm-fired fluidized bed boilers indicated unacceptable capital costs. Conversion from steam to a hot water system is not considered practicable. The plant is already cogenerating. Potential may exist for expansion to a residential/commercial complex being built near the South Street Bridge.

2.2.2.4 PITTSBURGH (EQUITABLE GAS)

Site Description - This steam system is owned by the Equitable Gas Company and operated by their "Energy Company." Contacts are John L. Magyar, Plant Manager, or Louis A. Kapfer, Director of Operations. Upper management, accounting, metering, and customer activity functions are provided by Equitable Gas Company. The Equitable Gas - Energy Company plant working staff consists of 1 plant manager, 2 plant foremen, 8 plant operators, 5 maintenance men, 1 utility man, 1 plant technician and 1 office clerk.

Operating Data - Heat capacity of the steam system is 240,000 lb/hr produced by two 20,000 lb/hr and one 100,000 lb/hr boilers. Boilers normally burn natural gas at a cost of $5.2345/MCF. Boilers operate at 83% efficiency.

Customers added to the system since 1969 are listed on Table 2-3. Since the installation of the system, no customers have withdrawn. Types of customers connected to the system are shown in Tables 2-2 and 2-3.

System History - The system was started in 1967 with two 20,000 lb/hr gas fired boilers. In 1972, a 100,000 lb/hr water tube boiler capable of burning natural gas or No. 2 oil was added. In 1978, the original boilers were modified for dual fuel capability at a cost of $114,000. Installation of economizers at an estimated cost of $300,000 is planned.

The owner has burned No. 4 oil in the boilers, with an approximate 4% reduction in fuel costs. The owner also has an advantageous contract for natural gas. The gas service combined with the No. 4 fuel oil is expected to provide a fuel cost savings between 8% and 9%.

Maintenance - Information was not provided.

Repair - Information was not supplied.

Potential Projects - The possibility of converting from steam to hot water distribution has not been investigated. A 1982 investigation of possible conversion to cogeneration was not encouraging.

TABLE 2-2

EQUITABLE GAS-ENERGY COMPANY

CUSTOMER DATA

Type Of Building	Steam Demand (lbs/hr)
Apartment Building 3	5,650
Apartment Building 7	5,250
Apartment Building 8	4,600
Apartment Building 10	5,250
Office Building 1	6,536
Office Building 2	9,200
Shopping Center	13,000
Townhouses	2,400
I.B.M. Building (office)	7,000
Allegheny General Hospital	70,000
Allegheny Prof. Building	1,150
Divine Providence Hospital	10,200
Sears Roebuck & Co.	7,800
Spectacor Corp. (Stadium)	9,000
Community College	10,500
Carnegie Library	4,000
Christian Miss. Church	1,300
N. S. Elementary School	7,800

TABLE 2-3

EXPANSIONS TO PITTSBURGH
(EQUITABLE GAS) SYSTEM 1969-1978

Year	Duration of Project (months)	Length of Piping Added (ft)	Customer Added	Heat Load (lb/hr)	Cost of Project
1969	8	1854	Three Rivers Stadium	9,000	$516,085
1969	8	1101	50-Unit Townhouse	2,400	59,965
1971	8	1717	Allegheny Com. College	10,500	154,348
1971	2	240	Apartment Bldg. 8	4,600	96,808
1972	2	30	Martin Luther King School	7,800	33,122
1972	2	145	Carnegie Library	4,000	68,464
1972	2	200	Apartment Bldg. 7	5,200	37,690
1973	8	1107	Allegheny Gen. Hospital	39,000	587,296
1974	3	500	Divine Prov. Hospital	10,200	192,710
1975	1	20	I.B.M. Building	7,000	57,606
1977	N/A	N/A	Allegheny Gen. Hospital (Addition)	31,000	N/A
1978	N/A	N/A	Allegheny Prof. Bldg.	1,150	N/A

2.2.2.5 PITTSBURGH (PACT)

Site Description - The system, owned and operated by Pittsburgh Allegheney County Thermal, Ltd. (PACT) for the past 2 years, has been in operation for 57 years. Contacts are Phillipp C. Krepps, Operations Manager, and Robert S. Wilson, President. The system working staff consists of 4 foremen, 8 operators, 9 maintenance men, 1 executive secretary, 1 plant clerk, and 1 accountant.

Operating Data - System capacity is 500,000 lb/hr of steam produced by four 125,000 lb/hr package boilers. Boilers normally burn natural gas, with No. 2 oil back-up. Cost of gas is $4.279/MCF and oil $0.83/gal. Plant operating efficiency is 84%.

Types of buildings connected to the system are:

Type of Building	% of Total
Office	90
Storage	2
Parking	2
School	1
Post office	2
Hotel	1
Other	2

System History - There have been no changes in the number of customers over the past ten years. Condensate polishers, new condensate pumps, piping, etc., were added to the feedwater system at a cost of $200,000.

Maintenance - Maintenance procedures are summarized as follows:

Maintenance Procedure	Frequency	No. of Laborers	Time Involved	Labor Rate*
Shutdown of system (winter-only customers)	1/yr	9	1 wk/man	$11.25/hr
Start-up of system (winter-only customers)	1/yr	9	1 wk/man	$11.25/hr
Inspection of four boilers and auxiliary equipment	1/yr	3	1 wk/man	$11.25/hr

* Without fringe benefits

Repair - Failures encountered in 1983 were:

Nature of Failure	Method of Locating	Cost for Locating	Nature of Repair	Cost of Repair
Condensate line failure	Visual (also system load increase)	$1,000	Blank lines before rupture	$7,500
Steam trap failure	Visual	$50	Rebuild or replace	$100

Potential Projects - There appears to be no potential for converting from steam to hot water or for cogeneration. To cogenerate, installation of higher pressure boilers would be necessary. There is some interest in investigating conversion to coal, either in the present boilers or in new boilers.

2.2.2.6 SCRANTON (6)

Site Description - TFN Inc., WHM Enterprises, Inc., and National Utilities, Inc., under the title of the Community Central Energy Corp., own and operate the system. It has been in operation for 95 years. A contact is Archie W. Field. The working staff are: 1 president, 1 vice-president, 1 bookkeeper, 1 billing and accounts receivable clerk, 1 distribution supervisor, 1 distribution welder mechanic, 1 welder's helper, 2 laborers, 4 boiler room operators, 1 plant welder/mechanic, 1 feed water treatment helper, 2 serviceman/meter readers.

Operating Data - System heat capacity is 368,000 lb/hr of steam, supplied from one each 70,000, 65,000, 33,000 lb/hr boilers and two 100,000 lb/hr boilers. Boilers burn No. 6 oil or natural gas, costing $0.7296/gal and $0.6289/CCF, respectively. Plant operating efficiency is 70.43%.

The types of buildings connected to the district heating system are:

Type of Building	Quantity	Annual Steam Usage (1,000 lb/yr)	% of Total
Office	9	19,810	10.9
Commercial	98	34,838	19.3
Industrial	4	9,835	5.4
School	33	62,320	34.4
Residential	147	18,847	10.3
Co., State and Fed. Bldgs.	14	27,997	15.5
Churches	14	7,623	4.2
Total	319	181,120	

System History - Table 2-4 shows additions and withdrawals of pipe runs between 1965 and 1985, Table 2-5 lists customers added to the system and Table 2-6 lists the largest customers that have left. As the tables show, the net reduction in heat load is 4,229,000 lb/yr, or 2.3% of the total yearly demand. Presently, the system tends to lose rather than gain customers. Heat loads of new customers are rather small, and those of customers leaving the system are inconsequential.

In 1976, a 100,000 lb/hr boiler was added, and in 1982, a 33,000 lb/hr boiler was added. In 1965, four boilers were converted to oil from coal. In 1978, a 400,000 lb/hr deaerator was installed. It is planned to convert boiler 6 from oil to coal, at an estimated cost of $1,900,000; the boiler will produce 100,000 lb/hr steam. A high pressure coal fired boiler planned for installation in 1987 will generate 70,000 lb/hr steam at 600

TABLE 2-4

PIPING CHANGES IN SCRANTON
STEAM DISTRIBUTION SYSTEM, 1965-1985

Year	Duration of Project (Days)	Length of Piping Added (ft)	No. of Customers	Heat Load (lb/hr)	Cost of Project
			ADDITIONS		
1965	60	1200	3	1287	$12,800
1967	60	590	2	310	6,000
1968	20	220	1	160	4,000
1970	15	110	3	105	1,100
1971	30	260	2	755	4,100
1972	78	4000	4	1855	118,000
1976	30	270	1	1126	6,500
1978	60	1100	0	0	106,000
1979	20	140	1	251	10,000
1985	26	310	1	505	26,000
			WITHDRAWALS		
1967	2	685	6	220	$200
1970	2	700	3	90	200
1971	2	1100	0	--	300
1981	2	550	1	30	200
1982	2	1500	0	--	400

TABLE 2-5

CUSTOMERS ADDED TO SCRANTON STEAM DISTRIBUTION SYSTEM

Customer	Annual Steam Usage (1000 lb/yr)
Adams Plaza	8443
Mulberry Towers	1451
Elm Park Church	1772
Meals on Wheels	948
Myer Davidow Foundation	750
Bishop Hannon High School	2878
Diocese of Scranton	1711
GSA	5830
Genalite Corp.	786
Bradley Lawless	480
Jewish Community Center	3933
University of Scranton	
Library	1798
Gallery	380
Science Building	2143
Student Center	1885
Dormitories	3030
Dormitories	3634
Dormitories	3716
Dormitories	4000
Total	49,568

TABLE 2-6

LARGEST CUSTOMERS LOST FROM SCRANTON STEAM DISTRIBUTION SYSTEM

Customer	Address	Annual Steam Usage (1000 lb/yr)
Clay Ave. Apts.	530 Clay	4035
Connell Building	128 Washington	4008
Masonic Temple	420 Washington	2441
Bank Towers	Wyoming & Spruce	7090
Conrail	S. Washington	4086
St. John's Lutheran Church	425 Jefferson	572
Girl Scouts	333 Madison	874
Pettinato	509-11 Linden	2755
Burne Oldsmobile	1201 Wyoming	1366
Anthracite Overall Bldg.	430 Penn Ave.	614
Shevott Inc.	515 Linden	837
St. Lukes Church	232 Wyoming	1645
Triangle	301 Lackawanna	907
Scranton Life Bldg.	538 Spruce	5652
Madison Town House	523 Madison	804
Wm. Wilson	338-46 Adams	726
Scranton Hotel	500 Wyoming Ave.	1680
Pettinato Bldg. (Fire)	317 Washington	1573
Casey Parkway	116-38 Adams	2100
DiLeo & Slawitsky	618-28 Spruce	720
Medical Arts Bldg.	327 N. Washington Ave.	2005
Chamber of Commerce Bldg.	440 Mulberry	2535
Miller Bldg.	420 Spruce St.	1430
Scranton Dodge	1140 Wyoming	1042
Fire Headquarters	510 Mulberry	1010
Century Club	612 Jefferson	610
GAR Memorial	301 Linden	680
	Total	53,797

psi to be used for cogeneration to produce 2 MWe and steam for district heating. Estimated cost is $5,800,000. The unit will use approximately 25,000 tons of coal annually.

Maintenance - Maintenance information is presented in Table 2-7. A program for the maintenance of pipelines is being considered; much of the distribution system was replaced recently.

Repair - Approximately 100 leaks occur during the year. They are attributed to anchor, valve and trap failures; leaks on service or mains pipes/fittings ; corrosion; electrolysis; age deterioration; water damage; damage by digging equipment. Manholes are located from 250 to 50 feet apart, with valve boxes between them for service line connections. Hot spots are easy to detect. When valves, steam mains, expansion joints, service lines or traps leak, they are replaced. To locate leaks, one man is dispatched to check any hot areas and then two men check the manholes and/or valve boxes to ascertain exactly what is leaking and perform repairs.

Potential Projects - A study began in January 1986 to investigate all aspects of the Scranton system in an attempt to identify methods of improving performance. The potential for conversion to hot water, alternate energy sources, cogeneration, and expansion will also be considered.

TABLE 2-7

SCRANTON STEAM DISTRIBUTION SYSTEM MAINTENANCE PROGRAM

Maintenance Procedure	Frequency	No. of Laborers	Time Involved(hr)	Average Labor Rate ($/hr)
Repack all valves - steam, oil, air	Annually	1	320	$7.76
Repack all pumps - turbines	Annually	1	20	$7.76
Water wash all boilers	Annually	1	120	$7.76
Water wash drums & tubes - all boilers	Annually	1	32	$7.76
Replace gaskets - drums & various tubes	Annually	2	40	$7.76
Clean tube bundles - oil, steam, water	Annually	1-1/2	60	$7.76
Replace oil in pumps & turbines	Annually	1	6	$7.76
Rebuild PRVs	Annually	1	60	$7.76
Wash & clean zeolite softeners	Annually	1-1/2	44	$7.76
Replace boiler & economizer tubes	As req.	2	400	$7.76
Replace or repair steam traps	As req.	1	32	$7.76
Repair building or roof	As Req.	4	200	$7.76
Check oil - A/C, pumps, turbines	Daily	1	116	$7.76
Lubricate moving auxiliaries	Daily	1	116	$7.76

2.2.2.7 WILKES-BARRE [5,7]

Site Description - The system, owned and operated by the Wilkes-Barre Steam Heat Authority, has been in operation for 80 years. Contacts are Charles Conlin, General Manager, and Daniel Sweeney, Operations Manager. A general manager, secretary, and 20 operators staff the system.

Operating Data - Heat capacity of the system is 321,000 lb/hr of steam generated in two coal burning boilers, three No. 2 oil burning boilers, and one fluidized bed boiler burning culm. Boiler capacities are 100, 80, 60, 27, 27, 27 thousand lb/hr, respectively. The County Courthouse uses 30% of the steam produced. Other customers include: federal buildings, all city government buildings, a hotel, Kings and Wilkes Colleges (each having about 20 buildings connected to system), several large apartment complexes, and approximately 25 residential buildings.

System History - In 1973, the system served 711 customers and operated with five boilers producing 3,000,000 lb/day of steam on the average. By 1985 the system served about 200 customers and operated with one boiler producing 1,200,000 lb/day on the average (two boilers are used on very cold days).

Problems acquiring new customers in the downtown area are attributed to the great sales capabilities of the larger utilities and the high cost of the steam produced for the system. Inefficient boiler operation, a deteriorating distribution system and an antiquated metering system lead to high costs. Eighty percent of the distribution system was replaced in the last 8 years; a condensate return line was considered but not installed. The fluidized bed boiler which burns anthracite waste (culm) has experienced problems which are being corrected by the boiler manufacturer. Economic operation of this boiler should lead to expansion of the service area.

Maintenance - Maintenance information was not supplied.

Repairs - Repair information was not supplied.

Potential Projects - Conversion to a hot water system was investigated and rejected at the time when the distribution system was scheduled to be replaced. It appears that there might be difficulty in generating interest or funds for a cogeneration study. Providing steam to absorption chilling units for district cooling might be worth investigating.

There is a need to increase the system load, but this is difficult in view of the marketing capabilities of larger utilities. (Condominiums being constructed in the downtown area, which represent potential expansion sites, will probably use other heat sources.)

2.3 CONCLUSIONS AND RECOMMENDATIONS

Harrisburg - Installation of cogeneration units may decrease costs sufficiently to attract needed customers. Numerous leaks have increased operating costs. Consideration should be given to replacing the pipelines and converting to hot water. Funds for studying such changes might be helpful to the owners.

Erie - The system uses coal and cogenerates. The generating station is deteriorating, and there is an ash disposal problem. A life extension study being performed may reveal some solutions to these and other problems causing a decrease in customers. Additional funds might be helpful in completing the life extension study and implementing recommendations.

Philadelphia - Addition of boilers indicates that the system has expanded since 1950. If culm-fired fluidized bed boilers actually prove efficient and economical, they might be of interest for the system in Philadelphia. (The owners previously rejected this technology.)

Pittsburgh (Equitable Gas) - The system has been expanding steadily and, with good maintenance practices, should be viable for many years. Conversion to alternate fuels or a hot water system might be investigated.

Pittsburgh (PACT) - Up to 65% of the condensate is returned, which improves operating costs. Customer load is stable. The feasibility of converting to coal might be investigated.

Scranton - Customer load seems stable. A study currently being performed explores all aspects of the system. Financing conversion of one boiler from oil to coal and installation of a coal fired boiler with cogeneration might be facilitated by low-interest loans.

Wilkes-Barre - There have been major withdrawals of customers since 1973. Hopes for making the system competitive are based on the success of a new fluidized bed boiler that has experienced problems. Cogeneration might be investigated as a solution to reducing costs.

General - For a district heating system to be successful, it must be able to provide heating to the service area in a reliable manner at a competitive cost. Then to keep the system in an efficient operating condition, good maintenance practices are required. In this respect, the distribution system is particularly important and should be maintained on a periodic basis including:

- o Pressure testing of distribution-related systems that require sealing for protection, e.g., conduits

- Testing for detection of leaks in distribution piping
- Visual inspection of manholes, including expansion devices, traps, joints and valves; repacking of joints and valves as required
- Monitoring of make-up water requirements in order to detect major leakage in piping
- Maintenance of steam traps, a common cause of losses

Although systems surveyed use steam as the heating medium, hot water systems are generally more efficient and have advantages such as:

- Providing the capability of heat transmission over longer distances with lower heat losses
- Minimizing loss of condensate and thus eliminating need for large amounts of high quality, chemically treated make-up for boilers
- Lower surface temperatures on radiators, thus providing better sanitary and safety conditions and eliminating decomposition of organic dust and release of harmful substances.
- Elimination of steam traps, with their usual energy loses.

If a potential exists for a steam system to convert to hot water, it should be studied carefully because conversion necessitates major, costly changes.

Utilizing fuels other than oil or natural gas might reduce system operating costs. Coal, biomass or solid waste may be options, with back-up units fired by gas or oil. Such conversions are also costly and must be carefully planned. Feasibility studies reveal the potential for fuel conversion.

Cogeneration of thermal and electric energy may be another way to increase system efficiency. Steam systems generally have a low thermal efficiency because the steam is produced at high pressure to compensate for pressure losses inherent in distribution piping systems. This steam may be more efficiently utilized if passed through an electric generating turbine before distribution in the district heating system. Again, this would have to be fully assessed in a detailed study.

Projects aimed at maintaining and/or enhancing current operating systems would be valuable. Interaction with a district heating committee within Pennsylvania that could provide technical and financial guidance would be beneficial. The committee could select systems that warrant assistance based on need and the merits of the proposed concept.

TABLE 2-8

OPERATING DISTRICT HEATING SYSTEM

CONTACTS

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Mr. Harry Wylie
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Mr. Robert Wilson
President
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(412) 553-5704

Harrisburg Steam Works Ltd.
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Harrisburg, PA 17105
(717) 257-5936

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4. Telecon, R. Dornsife (GEC) to F. Marcazzo (B&R), "Operating District Heating Systems in Pennsylvania", July 17, 1985.

5. Telecon, F. Marcazzo (B&R) to W. Stinson (Penn Elec), "Erie District Heating System", March 26, 1986.

6. Conference Notes, F. Marcazzo (B&R) and A. Field (Community Central Energy Corp), "Scranton District Heating System", December 5, 1985.

7. Conference Notes, F. Marcazzo (B&R) and C. Conlin (WBSHA), "Wilkes-Barre District Heating System", December 4, 1985.

TABLE 2-9

DISTRICT HEATING NETWORKS OPERATIONAL EXPERIENCE

Name of District Heating System	Harrisburg Steam Distribution System	Pennsylvania Electric - Erie	Philadelphia Electric Co. - Steam Heating System
Identification Number	101	102	103
Location	Harrisburg, PA	Erie, PA	Philadelphia, PA
Owner	Pennsylvania Power & Light Co.	Pennsylvania Electric Co.	Philadelphia Electric Co.
OPERATIONAL			
1. Heat Capacity of System	500,000 lb/hr steam	400,000 lb/hr steam	2,000,000 lb/hr steam
2. Number, Age and Type of Boilers	One 1948 Stoker converted to oil in 1972 Three 1972 Package C.E. Type "A"	Two 1942 Erie City Two 1952 C.E.	All water tube boilers See Note 1
3. Rated Capacity of Boilers	One 80,000 lb/hr steam Three 140,000 lb/hr steam	Two 175,000 lb/hr steam Two 450,000 lb/hr steam	Note 1
4. System Years in Service	98	87	82
5. Heating Medium	Steam	S.H. Steam	Steam
6. Pressure (psig):			
Winter	150HP, 30LP (Tariff 90HP, 3 to 30LP)	4 to 6 psig end of line and 250 psig	Actual Average 150 psig Tariff 55 psig
Summer	150HP, 30LP	4 to 6 psig end of line and 250 psig	Actual Average 150 psig Tariff 125 psig

(continued)

Identification Number	101	102	103
7. Temperature Range (°F):			
Supply Line	400 to 420	400	375
Return Line	-	-	-
8. If steam, Is Condensate Returned	No	No	No
9. Percentage Condensate Returned (or Make-up Required)	100% Make-up	100% Make-up	100% Make-up
10. Cost of Make-up Water($/1000 gal)	0.6364	NA*	0.65 to 1.26
11. Type of Chemical Treatment for Boiler Feed and Make-up Water	Softeners, Sulphite Vertan 600	NA*	Edison Steam Plant - Zeolite Softeners Schuylkill Gen. Sta. - Demin. Plant
12. Cost of Chemical Treatment ($/1000 gal)	32	NA*	250 (estimated)
ENERGY USE			
13. Type of Fuel Burned	Oil	Coal	Oil (0.3-0.5% Sulphur)
14. If Oil, Note Grade	No. 6	-	No. 6
15. If Coal, Note Type	-	Bituminous	-
16. Heating Value of Fuels:			
Oil (Btu/gal)	148,379	-	146,000
Gas (Btu/ccf)	-	-	-
Coal (Btu/lb)	-	12,000	-
Other	-	-	-
17. Annual Consumption:			
Oil, Gas or Coal	4,300,300 gal. oil	30,500 tons coal	Edison: 117,200 gal. oil Schuylkill: 1,288,000 gal. oil
Purchased Steam Equiv.	1,238,400 gal. oil	-	-
[illegible]	5,538,700 gal. oil	30,500 tons coal	1,405,200 gal. oil

(continued)

Identification Number	101	102	103
18. Cost of Fuel:			
Oil ($/gal)	0.7098	-	0.6697
Gas ($/ccf or $/therm)	-	-	-
Coal ($/ton)	-	43.11	-
19. Fuel Cost per Year Over System Life	NA*	NA*	NA*
20. Plant Operating Efficiency,%	81.5	80	84.6 to 87.3
21. Is Plant Cogenerating	No	Yes	Yes
22. If so, Load Produced (MWe)	-	118	141,600 Mwhr
23. Method of Electrical Production	-	Steam Turbine	Steam Turbine, Topping Unit
24. Cost of Electricity Sold ($/Kwhr)	-	0.062	0.047
SYSTEM HISTORY			
25. Expected Remaining Plant Life	40+ years	NA*	15 years
26. Expected Remaining System Life	20 years	NA*	15 years
MAINTENANCE			
27. Total Maintenance Cost Per Year	$386,000	NA*	$5,000,000
28. Any Procedure to Monitor Heat Losses	Yes	Yes	No
If Yes, Method	Steam Sendout Minus Steam Sold	Steam Sendout Minus Steam Sold	-
REPAIR			
29. Total Repair Cost Per Year	$450,000	NA*	NA*

(continued)

Identification Number	101	102	103
CUSTOMER DATA			
30. Cost of Heat Sold ($/1000 lb steam)	14.40	10.56	16.00
DISTRIBUTION			
31. Piping Size:			
Main Transmission	20" Sch. 20 16" Sch. 30 12" to 4" Sch. 40	3" to 20" No Schedule mentioned.	1-1/2" to 24" Sch. 40
Customer Distribution	16" Sch. 30 12" to 4" Sch. 40 2" Sch. 80	NA*	NA*
32. Piping Length:			
Main Transmission	11,000 ft H.P. (150 psig) Supply Only	6.63 miles Supply Only	32 miles Supply Only
Customer Distribution	25,000 ft L.P. (30 psig) Supply Only	NA*	NA*
33. Types of Piping Installation			
Conduit	-	Note 2	-
Concrete Trench	-	Note 2	-
Rigid Concrete Envelope	29,500 ft.	Note 2	29 miles
Ductless Directly Buried in Powder Backfill	200 ft.	Note 2	-
Other	1,000 ft. (Split Tile) 5,300 ft. (Wood Log)	-	3 miles (aboveground insulated)

* NA refers to "Not Available"

DISTRICT HEATING
NETWORKS OPERATIONAL EXPERIENCE

Name of District Heating System	Community Central Energy Corp.	Allegheny Center	Pittsburgh Allegheny County Thermal, Ltd. (PACT)	Wilkes-Barre Steam Heat Authority
Identification Number	104	105	106	107
Location	Scranton, PA	Pittsburgh, PA	Pittsburgh, PA	Wilkes-Barre, PA
Owner	T.F.N., Inc.; WHM Enterprises, Inc.; National Utilities, Inc.	Equitable Gas-Energy Co.	PACT	Municipal Authority
<u>OPERATIONAL</u>				
1. Heat Capacity of System	368,000 lb/hr steam	240,000 lb/hr steam	500,000 lb/hr steam	321,000 lb/hr steam
2. Number, Age and Type of Boilers	One 1921, one 1926, and one 1927 water tube One 1976 and one 1982 waterwall	Two 1966 water tube One 1972 water tube	Four 1983 Zurn Keystone M21 Package "O" Type	Two Keeler Coal Stoker Three York Shipley, One Fluidized Bed Boiler (culm)
3. Rated Capacity of Boilers	70,000; 100,000; 65,000; 100,000; 33,000 lb/hr steam	Two 70,000 lb/hr steam One 100,000 lb/hr steam	Four 125,000 lb/hr steam	100,000; 80,000; 60,00 three @ 27,000 lb/hr s
4. System Years In Service	95	19	57	80
5. Heating Medium	Steam	Steam	Steam	Steam
6. Pressure (psig):				
Winter	40	235	150(sat.) and 15(sat.)	105-125 in plant 5 to 35 in street
Summer	20	235	150(sat.) and 15(sat.)	-

(continued)

Identification Number	104	105	106	107
7. Temperature Range (°F):				
Supply Line	260 to 300	406	367 (HP), 250 (LP)	281 to 353
Return Line	-	150 to 180; avg. 165	120 to 180	-
8. If steam, is Condensate Returned	No	Yes	Yes	No
9. Percentage Condensate Returned (or Make-up Required)	100% Make-up	92.7% Condensate	35-65% Condensate	100% make-up
10. Cost of Make-up Water($/1000 gal)	1.10	1.30	1.35	NA
11. Type of Chemical Treatment for Boiler Feed and Make-up Water	Caustic soda, phosphate, sodium sulfite	Chelant	Sodium Zeolite Softener	Salt brine sulphite phosphite
12. Cost of Chemical Treatment ($/1000 gal)	1.60	1.30	10.00	NA
ENERGY USE				
13. Type of Fuel Burned	Oil & Natural Gas	Natural Gas and/or Oil	Natural Gas (w/Oil Backup)	Oil, Coal
14. If Oil, Note Grade	No. 6	No. 2	No. 2	No. 2
15. If Coal, Note Type	-	-	-	Culm, Barley
16. Heating Value of Fuels:				
Oil (Btu/gal)	150,000	139,600	140,000	NA
Gas (Btu/ccf)	103,000	102,800	103,000	-
Coal (Btu/lb)	-	-	-	12,000; 6500 (culm)
Other	-	-	-	-
17. Annual Consumption:				
Oil, Gas or Coal	3,246,300 gal. oil 252,500 ccf gas	9,195,100 ccf gas See Note 3	7,189,100 ccf gas	NA
Purchased Steam Equiv.	-	-	-	-
Total	-	9,195,100 ccf gas	7,189,100 ccf gas	-

(continued)

Identification Number	104	105	106	107
18. Cost of Fuel:				
Oil ($/gal)	0.7296	-	0.83	NA
Gas ($/ccf or $/therm)	0.6289/ccf	0.5234/ccf	0.4279/ccf	-
Coal ($/ton)	-	-	-	est. $16/ton (cylm) est. $60/ton (barley)
19. Fuel Cost per Year Over System Life	$1,892,000 over past 13 years	$2,609,000 over past 9 years	$3,300,000	NA
20. Plant Operating Efficiency,$	70.4	83	84	NA
21. Is Plant Cogenerating	No	No	No	No
22. If so, Load Produced (MWe)	-	-	-	-
23. Method of Electrical Production	-	-	-	-
24. Cost of Electricity Sold ($/Kwhr)	-	-	-	-
SYSTEM HISTORY				
25. Expected Remaining Plant Life	20 to 30 years	NA	20 years	NA
26. Expected Remaining System Life	20 to 30 years	NA	50+ years	NA
MAINTENANCE				
27. Total Maintenance Cost Per Year	$24,000	NA	NA	NA
28. Any Procedure to Monitor Heat Losses	No	No	No	NA
If Yes, Method	-	-	-	-
REPAIR				
29. Total Repair Cost Per Year	$104,000	NA	$200,000	NA

(continued)

Identification Number	104	105	106	107
CUSTOMER DATA				
30. Cost of Heat Sold ($/1000 lb steam)	15.08 to 16.36	12.40 to 13.60	16.50	13.46 to 16.38
DISTRIBUTION				
31. Piping Size:				
Main Transmission	6" to 24" Some Sch. 40 Most XH	8" to 12" Sch. 40	8" to 24" Sch. 40	NA
Customer Distribution	2-1/2" to 8" Some Sch. 40 Most XH	3" to 6" Sch. 40	1" to 14" Sch. 40	NA
32. Piping Length:				
Main Transmission	66,700 ft. Supply Only	8,300 ft. Supply and Return	25,000 ft. Supply Only	25,500 Supply Only
Customer Distribution	32,000 ft. Supply Only	NA	5,000 ft. Supply Only	NA

(continued)

NOTE 1:

Schuylkill Generating Station

Boiler	Year Installed		Pounds/Hour	
23	1937		530,000	
24	1937		480,000	
26	1972		550,000	
2	1967		180,000	
3	1968		180,000	
		Sub-Total	1,920,000	Actual output limited to 1,200,000 lb/hr due to production capabilities of the feedwater demineralizing plant.

Edison Steam Plant

Boiler	Year Installed		Pounds/Hour
1	1958		180,000
2	1958		180,000
3	1971		220,000
4	1969		220,000
		Sub-Total	800,000
		Grand Total	2,000,000

NOTE 2:

The system has four types of piping installation, viz, conduit, concrete trench, rigid concrete envelope, and ductless directly buried in powder backfill. However, there is no information on the percentages of each type of installation.

NOTE 3:

Annual fuel consumption includes summer months for production of chilled water for cooling load.

3.0 ABANDONED DISTRICT HEATING SYSTEMS IN PENNSYLVANIA

3.1 INTRODUCTION

All abandoned district heating systems in Pennsylvania were identified, and the reasons for abandonment were investigated. Where sufficient information was available to draw any inferences, possible solutions or programs are suggested so as to prevent the failure of any present or future systems having similar designs and/or undergoing similar economic problems. Any indication of potential reactivation was also considered.

3.2 GENERAL DISCUSSION

District heating systems are essentially reliable in providing thermal energy; however, problems may cause failure and abandonment. Such problems include:

- o Substantial reduction in heat load
- o Major equipment failures
- o Major transmission and distribution (piping) failures
- o Inefficient plant operation
- o Reduced reliability due to system age
- o Rising fuel costs
- o Competition from other modes of heating
- o High maintenance/repair costs
- o Legal complications

Most piping in a district heating system is buried, and maintenance is virtually impossible. Groundwater infiltration is the most common and destructive cause for piping corrosion.[1] A piping system often consists of a carrier pipe transporting the heating medium, insulation covering the carrier pipe, and a metal casing covering the insulation. Groundwater may infiltrate the casing and saturate the insulation covering the carrier pipe, leading to corrosion and leakage. This results in losses of the heating medium or return fluids; concurrently, system efficiency decreases and maintenance and repair costs increase.

When equipment is not properly maintained, it tends to fail prematurely. The cost of replacing or repairing the worn equipment can become prohibitive. Old equipment tends to be "down" often, resulting in lost revenue and increased expenses. Even when such equipment operates, it is often at a low efficiency.

Competition of conventional individual heating systems can cause customers to withdraw from district heating systems. The consequent reduction in heat load can adversely affect system economics.

3.3 SURVEY

3.3.1 PROCEDURE

Information was obtained through literature research, contact with persons knowledgeable of district heating in Pennsylvania, contact with the International District Heating and Cooling Association, indication of an abandoned site from one surveyed as a potential site, and previous experience of Burns and Roe in Pennsylvania. The 26 sites presumably having had district heating systems are are listed below. A questionnaire sent to those on the list was designed to accumulate data pertaining to the system, including: general information, operational data, energy use, reasons for abandonment, possible reactivation, distribution. When questionnaires were returned, contact was made to clarify information provided and obtain more detail.

PRESUMABLY ABANDONED DISTRICT HEATING SYSTEMS IN PENNSYLVANIA

Allentown	Germantown	Sewickley
Aspinwall	Hazleton	Sharpsburg
Bellefonte	Lebanon	Springfield
Bloomsburg	Lock Haven	Wayne
Clearfield	Louis Jones(Phila.)	Westchester
Coatesville	Overbrook (Phila.)	Wilkinsburg
Easton	Philipsburg	Williamsport
Etna	Reading	York
Frankford Arsenal (Phila.)	Renovo	

3.3.2 Results

Of the 26 presumably abandoned systems, 10 replied with the return of the questionnaire and/or by telephone.

York	Philipsburg
Springfield	Williamsport
Bloomsburg	Coatesville
Easton	Aspinwall
Wilkinsburg	Sewickley

Aspinwall and Sewickley apparently did not have systems: Some other respondents could provide only limited information because the systems were abandoned many years ago and no records are available.

3.3.2.1 York

The York Steam Heating System, operated by Metropolitan Edison Company, went out of service in 1977 after operating for about 75 years. The boilers were removed from the plant, now under private ownership. The city owns the dismantled piping system and has granted its use as conduit to another utility.

Three 65,000 lb/hr boilers and one 40,000 lb/hr boiler, all burning No. 6 oil and natural gas, were installed new in 1963. Steam was produced at 150 psig, distribution pressure was 10-40 psig, and supply line temperature was about 360°F.

Years ago Metropolitan Edison bought the plant mainly for its electrical capability but when the generators (one 1500 kW and other 5000 kW) went out of service in 1959 they were not replaced, and the plant was used to produce steam only. The steam plant operated until 1977, when much reduced heat loads made it uneconomical.[5] (The owner had not made much effort to retain customers.) Heat load was reduced because some businesses went bankrupt and abandoned their buildings, some buildings were torn down to build parking lots, and some high heat load customers left the system to install their own central heating systems.

With the piping system being used for other purposes and the other equipment sold, there is no district heating system to reactivate. Former customers have installed their own boilers, most relatively new. District heating economics would have to be very attractive before these customers would convert. Such an economic evaluation is beyond the scope of this study.

3.3.2.2 Springfield

Springfield was originally considered as a potential district heating site and was surveyed as such. In the process, it was discovered that a system installed in 1928 had been abandoned in 1931. People with some memory of the era indicated that there was fire at the plant and the heating system failed but did not know the reasons for the abandonment. The plant was razed around 1939.

Springfield officials are not enthusiastic about a new district heating system. Almost 80% of the community is made up of single family units, and heat load is rather small on a per unit area basis. Moreover, residents are apparently satisfied with their present heating systems. (6)

3.3.2.3 Bloomsburg

Hidley Oil Company owned the Bloomsburg Heating Company which provided district heating steam to the community until 1968 when the system was abandoned because of high fuel costs. At first, anthracite coal was burned and then No. 6 oil, which was expensive compared with natural gas that became available when Pennsylvania Gas and Water Company routed its gas piping through Bloomsburg. The Heating Company lost too many customers to remain profitable. According to the former owner, the piping system is now in poor condition. (7)

Bloomsburg consists mainly of single and two family units, with virtually no large buildings except for a university and a small hospital, each of which has its own heating system. The nearest possible heat sources (12 miles away) are the Susquehanna Nuclear Power Station and Washingtonville Power Plant (which burns coal). Both are owned by Pennsylvania Power & Light Company.

Bloomsburg officials might support reactivating the district heating system if it is economically feasible. However, a tight local budget inhibits them from studying the matter. (Several communities expressed the same concerns.)

3.3.2.4 Easton

The Easton steam heating system had three Edgemore Iron Co. water tube boilers, one rated at 1406 bhp, the others each rated at 1008 bhp, and all burning bituminous coal. Transmission line sizes ranged from 8 to 12 in. dia; distribution line size was 4 in. dia.

In 1967, Metropolitan Edison Company, the owner, applied to the Pennsylvania Public Utility Commission for approval to abandon steam heat service in Easton by June of 1968. Application for abandonment was approved. When the operation was terminated, the equipment was removed and the plant razed. Piping length is not known; condition is believed to be poor.

Reasons for abandonment (summarized from the application) are as follows:

- o The owner incurred large losses in the five years preceding their application and could see no prospect for recovery.

- o Steam heat service originated out of the use of exhaust steam which was a by-product of electricity generation. Electricity generation was abandoned in 1958 but steam was still manufactured to supply the small section then served. The plant was a mile from the area of service. Facilities were in poor condition.

- o Piping leaked badly. Steam loss was over 40%.
- o Rates sufficient to cover repairs and show a reasonable rate of return would be greater than the value of service.

Obviously, it is not practicable to reactivate the old system. However, Easton has expressed interest in the feasibility of a new district heating system. Since Easton has a special exception for hydroelectric development on the Lehigh River, development of an industrial site in the city is possible. Such an industrial site would provide high heat loads for a district heating system.

3.3.2.5 Wilkinsburg

A system owned and operated by City Ice and Fuel Company was abandoned in the 1920's. The company is defunct, and no information is available about the abandonment. Wilkinsburg is 95% residential and is made up of mainly single family units with virtually no high heat load customers.

3.3.2.6 Philipsburg

Little is known about a district heating system abandoned about 35 years ago. Apparently, the system was bought by Counties Gas Company, and portions of the steam piping are used for natural gas distribution. There has been no consideration of reactivating the district heating system. (11,12)

3.3.2.7 Williamsport

Little is known about a district heating system abandoned about 70 years ago. Williamsport is mostly occupied by single family dwellings.(13)

3.3.2.8 Coatesville

Occasionally, excavators uncover an abandoned line of what is believed to have been a steam district heating system. No information about the system is available.

3.3.2.9 Miscellaneous

The following information on other abandoned systems was gleaned from persons familiar with district heating in Pennsylvania:

<u>Frankford Arsenal (Phila.)</u> - A system abandoned about 1975 supplied heat over 75-90 acres.(10)

<u>Overbrook (Phila.)</u> - Located on the city line, this system went out of service around 1970 after experiencing many failures in distribution piping.(15)

<u>Louis Jones Steam Heating (Phila.)</u> - Located near the Overbrook system, this system was owned by Pennsylvania Utility Investment Corp. which at one time owned the Scranton and Wilkes-Barre systems.(14)

<u>Renovo</u> - Renovo Heating Company went out of business about 1970 after financial difficulties. Most customers were residential.(16)

<u>Wayne</u> - Partially owned by Philadelphia Electric Company, this small system served mainly residential customers. It went out of service

about 1950.(14,15)

West Chester - Constructed in the early 1900's, the West Chester system was abandoned in the 1970's and the plant was removed. In its most recent operation, the system provided 80,000 lb/hr of steam to 300 or 400 residential customers and some small commercial customers for 9 months of the year. The reasons for abandonment were not discovered. The former customers have other relatively new sources of heat and therefore might not be interested in district heating at present.(14,15)

3.4 CONCLUSIONS AND FUTURE CONSIDERATIONS

Scarcity of information regarding the abandonment of the district heating systems in Pennsylvania makes it difficult to determine its exact causes. However, based on the information provided and on Burns and Roe's understanding of district heating, the apparent causes for abandonment are discussed below and the means to prevent such causes are proposed.

3.4.1 Causes for Abandonment of District Heating Systems

3.4.1.1 Piping Problems

Leaks in the transmission distribution piping are common, particularly in old piping systems which have carbon steel casings over the insulation and carbon steel pipes. Although the casings are coated with tar and asphalt and are cathodically protected, ground water entering through any nicks attacks the casings and eventually the pipes. Old systems do not have leak detectors installed along the pipes. Consequently, leaks cannot be detected until they are so severe that the escape of steam manifests itself aboveground. The cost of replacing leaking pipes is high. Heat losses through the leaks increase operating costs as more steam must be produced to compensate.

3.4.1.2 Steam Problems

Steam was used as the heating medium in all of the old district heating systems. Low temperature hot water (less than 250°F) is used in modern systems for many compelling reasons.

For temperatures above 250°F (as encountered with steam), factory-insulated pipes using low cost insulation such as polyurethane foam are not available, and the pipes must be insulated in the field. Moreover, the insulating properties of polyurethane foam degrade when subjected to temperatures higher than 250°F. Depending on the type of insulation used, field-insulated pipe costs up to twice as much as factory insulated pipe.

A steam system also has a lower efficiency than a low temperature hot water system, resulting in higher operating costs. (This assumes a cogenerating system that uses steam to generate electricity before extracting it from the turbine and transmitting it at high pressure for heating purposes.) If low temperature hot water is used for space heating, steam can be extracted from the turbine at low pressures. This allows for more electricity generation than extraction at high pressures.

3.4.1.3 Heat Load Problems

Many of the abandoned district heating systems served areas with low density population and little industry. This type of operation is not economical and can easily be displaced by private heating systems. In other cases, changing economic conditions and times caused reductions in annual heat load and new customers were not found. Revenue dropped, plant and piping deteriorated to the point of no return, resulting in abandoned district heating systems.

3.4.1.4 Lack of Interest

Many older district heating systems were actually born through the electric industry in the form of cogeneration. The steam exhausted through the turbine-generators was pooled and piped to buildings for comfort heating, giving rise to a district heating system. In other cases, during the 1920's and 1930's, district heating systems tagged along so that utility companies could obtain customers who had previously generated their own electricity and steam.(17) Once the electric utility industry was established, the district heating system either became a separate division of the utility or was sold to other owners. The concentration on electrical generation led to the eventual deterioration and abandonment of the district heating systems.(19,22)

3.4.2 Possible Means to Preclude Future Abandonments

Each system must be considered individually, but the following measures are suggested for consideration:

- Install insulated piping with plastic casing such as polyethylene (plastics are not susceptible to groundwater corrosion).

- Install built-in leak detectors along underground pipes for quick means of locating leaks.

- o Perform periodic maintenance on system equipment to prevent equipment failure.
- o Use low temperature hot water instead of steam as the heating medium.
- o Explore cogeneration as a means for improving plant efficiency and profitability.
- o Explore lower cost available fuels such as coal or solid waste for combustion in prime mover.
- o Start district heating systems with islands (i.e., clusters of buildings) of high heat loads satisfied by steam from packaged boilers. Tie-in islands, thereby expanding the system and leading to a central plant and district heating for the entire area. Maintain packaged boilers for back-up.
- o Solicit new customers.
- o Form a committee of district heating experts to evaluate causes of abandonment, monitor operation of current systems, and facilitate implementation of new systems and repair of old ones.

3.4.3 Plan of Action for Abandoned Systems

Reactivation of abandoned systems in Pennsylvania seems unlikely. Except for York, Easton, Overbrook, and West Chester, the systems were abandoned 20 or more years ago, making it doubtful that the piping or other equipment would be salvageable. In most cases, the plants were razed and in Overbrook and West Chester the old equipment is probably beyond repair. However these sites may have the heat load density and nearby heat source that are necessary for economical district heating. The other sites listed appear somewhat less suitable for district heating for the apparent reasons given.

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4. Telephone Conversation, B. Eckert, Borough of Aspinwall to F. Marcazzo (B&R), District Heating System, September 5, 1985.

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6. Telephone Conversation, K. Lee (B&R) to Robert Giannini (Springfield Township, Delaware County), Abandoned District Heating System, January 29, 1986 .

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4.0 POTENTIAL DISTRICT HEATING SITES IN PENNSYLVANIA

4.1 INTRODUCTION

Assessment of potential district heating sites within Pennsylvania included identification of an existing heat load, potential heat sources and an indication of support by the community for studies to determine the feasibility of district heating.

4.2 GENERAL DISCUSSION

Consideration must be given to the following factors when first assessing the feasibility of district heating at any site:

Heat Load Density - Demands for space heating, domestic hot water heating, or hot water/steam for industrial processes or sterilization (hospitals) constitute a heat load. Buildings with high heat loads situated near each other constitute an "island" of high heat load density. A density of 60 to 90 MW thermal/square mile is sufficient to make district heating feasible.

Heat Source - There must be a boiler plant or large incinerator with waste heat available in the vicinity of the heat load.

Distance between Heat Source and Heat Load - The economical transmission distance is greatly dependent on the size of the heat load and must be determined case-by-case. Other factors affecting costs are piping and burial types, laws generating street opening, and ground conditions.

Possibility of Expansion - Phased expansion is usually the best approach, where a few customers are first served with district heat and the system expands in stages.

Available Coal or Refuse-Derived Fuel - Substantial fuel cost savings can be realized by providing heat from a central station burning coal or refuse-derived fuel.

Degree of Air Pollution - Generation of heat from a central plant offers a significant reduction of air pollution and heat discharged to the atmosphere when compared with individual heating systems.

If the assessment is favorable to district heating, a feasibility study can be performed. Such a study involves heat load and heat source assessments, and piping, environmental, and economic analyses.

Heat Load Assessment - This assessment identifies the suitable areas of a selected site for district heating development, determines the design temperature, the comparison of customer and system peak with annual heating loads and the system load duration curve.

Heat Source Assessment - This assessment identifies prospective heat sources. The most attractive heat source is a coal-fired electrical generating station which could be modified to provide district heat along with electricity (cogeneration). Refuse plants offer another inexpensive heat generation option. All heat sources are usually evaluated on the following criteria: cost, reliability, operating flexibility, thermodynamic and mechanical constraints, space availability, and structural design limits.

Piping System Analysis - This analysis develops in a conceptual form a district heating network that will connect the heat load with the heat source. Minimizing piping lengths by strategic routing lowers distribution cost, probably the most expensive item in the chain of costs relating to a new or upgraded district heating system.

Environmental Analysis - A district heating system replaces numerous heat sources with a central source, thus reducing air pollution. The extent of this improved air quality is evaluated, and safeguards for air pollution control are considered.

Economic Analysis - The economic analysis determines the necessary charges for district heating and compares them to costs of other forms of heating, including projections and availability of fuels. Favorable and unfavorable utility regulations are also analyzed.

4.3 SURVEY

4.3.1 Procedure

Sites were selected on the basis of potentially high heat load. The preliminary selection considered populations, winter design temperatures and annual heating degree day* data. The combinations of winter design temperatures and heating degree days were compared with those of Erie, Philadelphia and Pittsburgh, where operating systems exist. These sites have design temperatures of 9, 14 and 5°F, respectively, and heating

* Heating degree days - The difference between 65° and the daily mean temperature (half the total of the daily maximum and minimum temperatures), totaled for each day of a year.

TABLE 4-1

POTENTIAL DISTRICT HEATING SITES IN PENNSYLVANIA

City	Population	Design Temperature (°F) (1)	Heating Degree Days (2)	Weather Data (3)
Aliquippa	17,000*	7	5619	E
Altoona	57,078*	5	6850	A
Baldwin	25,268	5	5950	E
Bethel Park	38,362	5	5950	E
Bethlehem	72,550	9	5815	E
Broomall	25,040	14	4947	E
Butler	20,818	6	6673	A
Carlisle	19,972	11	5335	E
Chambersburg	16,114*	8	5594	A
Chester	45,794*	14	4947	E
Drexel Hill	31,000	14	4947	E
Easton	26,027*	9	5815	E
Havertown	36,500	14	4947	E
Hazleton	27,318*	5	6330	E
Johnstown	35,417	2	5768	A
Lancaster	53,000*	8	5527	A
Lansdale	20,430	14	5386	E
Lebanon	25,000*	11	5563	E
Levittown	72,000	14	4947	E
McCandless	22,404	5	5950	E
McKeesport	31,902	5	5950	E
Monroeville	31,439	5	5950	E
Mt. Lebanon	39,596	5	5950	E
New Castle	33,500*	7	5885	A
Norristown	34,626	14	5386	E
Penn Hills	62,886	5	5950	E
Plum	25,099	5	5950	E
Pottstown	26,144	14	5386	E
Radnor	27,676*	14	4947	E
Sharon	20,000*	7	6606	E
Springfield	25,500*	14	4947	E
State College	36,130*	7	6247	A
Upper Darby	43,500	14	4947	E
Warminster	35,500	14	4947	E
West Chester	20,721	13	5370	A
West Mifflin	26,577	5	5950	E
Wilkinsburg	23,600*	5	5950	E
Williamsport	33,401	7	6047	A
Willow Grove	25,874*	14	4947	E

*Actual data supplied by respondents. Others based on U.S. Census figures.

(1) - Reference - ASHRAE Fundamentals 1985 ed. Design Dry Bulb Temp.
(2) - Reference - National Oceanic and Atmospheric Assoc. Climatological Data. Figure represents seasonal norm or last recording.
(3) A - Actual data for site, E - estimated based on regional data.

degree days of 6451, 5144, 5987. All three sites fall within a design temperature range of 2°-14°F and heating degree days range of 4947-6850. These figures compare favorably with sites listed. Thirty-eight sites were selected originally and another (Chambersburg) added later. Table 4-1 lists the sites, populations and weather data.

A questionnaire sent to the 39 potential sites requested general information, site specific data, indication of potential heat sources, indication of potential heat loads, past consideration of district heating, and a map outlining residential, commercial and industrial sections and the locations of potential heat sources. Further contact was made by telephone when required.

4.3.2 Results

Responses were received from 17 of the 39 of the sites:

Aliquippa	Lancaster	Springfield
Altoona	Lebanon	State College
Chambersburg	Mt. Lebanon	Wilkinsburg
Chester	New Castle	Williamsport
Easton	Radnor	Willow Grove
Hazleton	Sharon	

Relevant data from the questionnaires was transferred to data sheets, and the sites were ranked as "good," "fair," or "none" as related to their potential for district heating installation:

Good	Fair	None
Aliquippa	Chambersburg	Mt. Lebanon
Altoona	Lancaster	Springfield
Chester	Radnor	Wilkinsburg
Easton	State College	
Hazleton	Williamsport	
Lebanon	Willow Grove	
New Castle		
Sharon		

All sites have between 5000 and 7000 yearly degree days which is important. The "good" sites have potential heat sources, heat loads and local interest in the concept. The "fair" sites have only one of the previously mentioned favorable characteristics. The "none" sites are those where a district heating feasibility is doubtful, along with a lack of community interest.

Those sites with seemingly high potential for district heating were encouraged to pursue further investigation. Initially, this would be in the form of a feasibility study. An engineering study and construction might follow. The U.S. Department of Energy has a "District Heating/Cooling Assessment Program" to support communities in developing district heating. Grants are available from DOE for feasibility studies. State energy agencies also sometimes contribute for these studies.

Visits were made to Chester, Hazleton, New Castle and Sharon because they all have a high potential for district heating. Meetings were held with city officials to discuss city characteristics related to district heating and to the extent of their support. Several calls were also made to Easton and Altoona because of their interest and high potential for a district heating operation. The outcome of this close communication between Burns and Roe, GEC and the communities involved, resulted in several applications to the DOE for funding of district heating studies.

The following are excerpts of the meetings with the ensuing results:

Chester [1] - This meeting was held with the mayor, city planner, state GEC member and representatives of local businesses who could be potential suppliers/users of heat. It was learned that the city had already completed a study for a refuse burning, steam producing facility which was given favorable reviews. Construction of this facility is expected within the next few years. An industrial corridor along the Delaware River represents a potential heat load. Several industries (including P. Q. Corporation, Penn Ship Building, and Scott Paper) might be customers, as well as a planned prison next to the prospective refuse/steam plant. Public housing units (1600), a school system, a college and a hospital are also potential heat users. Chester applied for DOE district heating study funds in March 1986.[2]

Altoona[3] - Four large institutions are being considered as potential heat sources: Conrail, the Altoona Area School District, Altoona Hospital and Mercy Hospital. The Conrail complex represents a fine heat source since it cogenerates with coal. The other three sources appear to have excess boiler capacity.[4] A corridor of buildings, including hospitals, schools, apartments, industry, offices and retail shops, represents a potential heat load. The city is dedicated to a program of urban renewal in which district heating could play a major role. Altoona applied for DOE district heating study funds in March 1986.[5]

Easton[6] - A steam district heating system was abandoned in Easton in 1968, after major distribution losses made it inefficient. The coal burning heat source was demolished. A city representative believes a reactivated or new system would benefit a current redevelopment program.[7,8] The area is heavily commercial and is adjacent to Lafayette College, representing a good heat load density. Light industry to the north and west may be potential loads/sources. Easton applied for DOE district heating study grants in March 1986.[9]

Hazleton [10] - A study of solid waste/cogeneration has been completed, but no plans have been made for construction. Four industrial parks (Beltway, McAdoo, Humboldt, Valmont) represent a heat load or possibly heat sources; two hospitals and several city buildings could be heat users. All these buildings are within 1 or 2 miles of each other which is well within the parameters established for district heating distribution. Interest seems to be developing for a study of the feasibility of district heating. Outlines of the input required for DOE grant applications were presented for Hazelton perusal and action.

New Castle[11] - The mayor and business administrator expressed interest in applying for funds to study the feasibility of district heating in conjunction with a refuse burning facility currently under study or with other potential heat sources such as the coal burning electric plant or large local boilers. They were advised to apply to DOE for funds for tie-in with the refuse facility and an evaluation of other heat sources.

Sharon[12,13] - The feasibility of district heating and its relationship to the Mercer County Resource Recovery Facility (in the permitting phase) was discussed with the mayor. An industrial/commercial corridor represents a potential heat load.

Aliquippa and Lebanon warrant further investigation to determinate whether it would be wise to proceed with a study of district heating feasibility. More related information is required from both these communities. Although limited, the available information appears favorable.

Aliquippa - A coal and refuse plant are potential heat sources. A large steel company, other industries and a hospital represent a heat load. Community leaders appear interested in investigating district heating.

Lebanon - Lebanon appears to have abandoned a district heating system. Two large steel companies represent potential heat sources/loads.

4.4 CONCLUSIONS AND FUTURE CONSIDERATIONS

Growth of a district heating program in Pennsylvania appears promising. Chester, Easton and Altoona are supporting the investigation of district heating in an effort to conserve energy, save money, and spur local development. Other cities with favorable characteristics for district heating lack commitment but may give district heating further consideration.

The District Heating Assessment Guidebook, a separate volume which is part of this contract, can be used to educate city officials and the public.

Interest in district heating feasibility studies can be stimulated by availability of state funds and DOE grants. A program should be developed by which state funds become available to cities which have the potential for community revitalization by development of a district heating system.

As mentioned earlier, a district heating committee could be a review board for funding applications.

DISTRICT HEATING
DATA FOR
POTENTIAL SITES

ALIQUIPPA

CONTACTS - Daniel Britza, Mayor

ADDRESS - 1629 Pierce Street 15001

TELEPHONE - (412) 375-5188

AREA (SQ. MILES) - 5

POTENTIAL HEAT SOURCES - Coal plant (Duquesne Light) 4 miles away; Ambridge Borough Incinerator 5 miles away.

POTENTIAL LARGE HEAT LOADS - LTV Steel; P. M. Moore Company; Aliquippa Hospital

COMMENTS - City was contacted and expressed interest towards studying D.H. but stated that funds were not available from the city to do so.

ALTOONA

CONTACTS - Linda Sommer, Planner III

ADDRESS - City Hall 16601-3491

TELEPHONE - (814) 944-7131

AREA (SQ. MILES) - 9.1

POTENTIAL HEAT SOURCES - Conrail (814) 949-1200; Blair County Home and Hospital

POTENTIAL LARGE HEAT LOADS - Conrail, Blair County Home and Hospital, Altoona Hospital, U.S Veterans Hospital, Mercy Hospital

COMMENTS - City is pursuing DOE funds for studying feasibility of D.H. through application submitted in March, 1986.

DISTRICT HEATING
DATA FOR
POTENTIAL SITES

CHAMBERSBURG

CONTACTS - Julio Lecuona, Borough Manager
Robert E. Eckman, Jr. Supt. Electric Dept.

ADDRESS - 100 S. Second Street 17201

TELEPHONE - (717) 264-5151

AREA (SQ. MILES) - 6.58

POTENTIAL HEAT SOURCES - Electric plant in town put out of service in 1975, but structure exists

POTENTIAL LARGE HEAT LOADS - Chambersburg Engineering Company; T. B. Woods; Knouse Foods; Kraft Foods; Pet Ritz; J. Schoeneman Company

COMMENTS - The city has shown some interest in D.H. They would like to become more knowledgeable of the concept.

CHESTER

CONTACTS - Stephen A. Merriken, Deputy Director of City Planning

ADDRESS - 401 Avenue of the States 19016

TELEPHONE - (215) 447-7881

AREA (SQ. MILES) - 4.8

POTENTIAL HEAT SOURCES - Electric Plant (PECo) 1 mile away;
P. Q. Corp., John Reed (215) 293-7303;
Scott Paper, Bill Synder (215) 874-4331

POTENTIAL LARGE HEAT LOADS - P.Q. Corp.; Scott Paper; Penn Ship

COMMENTS - After meeting with and review by B&R November 15, Chester applied for DOE funds in March, 1986 to study the feasibility of D.H.

DISTRICT HEATING
DATA FOR
POTENTIAL SITES

EASTON

CONTACTS - Gary L. Cleaver, Director of Planning
Salvatore LaRosa, Director of Public Property

ADDRESS - 650 Ferry Street 18042

TELEPHONE - (215) 250-6680, 250-6721

AREA (SQ. MILES) - 4.32

POTENTIAL HEAT SOURCES - Pfizer, Lee Emery 250-3000

POTENTIAL LARGE HEAT LOADS - Pfizer; Easton City Hall; Sewer and Water Auth. 250-6682, Northampton County Gov't. Center, Gene Hartzell 253-4111; Lafayette College

COMMENTS - Central Business District once serviced by steam D.H. System abandoned 1968, infrastructure still exists; hydroelectric power development. City interested in reactivating system. Has applied for DOE funds in March 1986 to study the feasibility of D.H. in Easton.

HAZLETON

CONTACTS - John Ford, Mayor, Joseph DeMarinis, City Clerk

ADDRESS - Church and Green Sts. 18201

TELEPHONE - (717) 459-4961

AREA (SQ. MILES) - 5

POTENTIAL HEAT SOURCES - Possible solid waste/cogeneration plant

POTENTIAL LARGE HEAT LOADS - Beltway Industrial Park; McAdoo Industrial Park; Humboldt Industrial Park; Valmont Industrial Park; St. Josephs Hospital; City buildings

COMMENTS - City has completed study of solid waste/cogeneration unit. Implementation represents potential heat source. Meeting was held by B&R with city to discuss possibility of studying D.H. They expressed some interest in doing so.

DISTRICT HEATING
DATA FOR
POTENTIAL SITES

LANCASTER

CONTACTS - Arthur Morris, Mayor, Kenneth E. Lawrence, Jr.

ADDRESS - 120 North Duke Street 17603

TELEPHONE - (717) 291-4739

AREA (SQ. MILES) - 5.7 ±

POTENTIAL HEAT SOURCES - ?

POTENTIAL LARGE HEAT LOADS - Armstrong World Industries (717) 397-0611

COMMENTS - County exploring waste plant with possible D.H. tie-in. Plant not necessarily for Lancaster.

LEBANON

CONTACTS - Martin Schneider, Mayor

ADDRESS - 400 S. 8th Street 17042

TELEPHONE - (717) 273-6711

AREA (SQ. MILES) - 5

POTENTIAL HEAT SOURCES - Bethlehem Steel, Richard Harris; Lebanon Steel Foundry, Thomas Quisan

POTENTIAL LARGE HEAT LOADS - Bethlehem Steel, Lebanon Steel Foundry

COMMENTS - District heating system existed and was abandoned 20 years ago. City has requested an introductory meeting to discuss D.H.

DISTRICT HEATING
DATA FOR
POTENTIAL SITES

MT. LEBANON

CONTACTS - J. W. Harrod Director of Public Works

ADDRESS - 710 Washington Road, Pitt. 15228

HEATING DEGREE DAYS - 5950

POTENTIAL HEAT SOURCES - None

COMMENTS - City claims there is no potential for district heating.

NEW CASTLE

CONTACTS - Dale W. Yoho, Mayor

ADDRESS - 230 N. Jefferson Street 16101

TELEPHONE - (412) 658-5698

AREA (SQ. MILES) - 25

POTENTIAL HEAT SOURCES - Coal plant (Penn Power) 5 miles away; Park Corporation

POTENTIAL LARGE HEAT LOADS - Rockwell, Robert Ayers 652-5571; Park Corp., Kelly Park 658-6449

COMMENTS - Currently investigating refuse burning plant. Is interested in obtaining information on D.H. and possibly studying the concept.

DISTRICT HEATING
DATA FOR
POTENTIAL SITES

RADNOR TOWNSHIP

CONTACTS - C. B. Guernsey, Township Manager

ADDRESS - 301 Iven Avenue, Wayne, PA 19087

TELEPHONE - (215) 688-5600

AREA (SQ. MILES) - 14

POTENTIAL HEAT SOURCES - Villanova University

POTENTIAL LARGE HEAT LOADS - Radnor Corporate Center

COMMENTS - Might be interested in exploring D.H. in late 1986.

SHARON

CONTACTS - Robert T. Price, Mayor

ADDRESS - 155 Connelly Blvd. 16146

TELEPHONE NUMBER - (412) 983-3225

AREA (SQ. MILES) - 4

POTENTIAL HEAT SOURCES - Mercer County Resource Recovery Facility (in permitting phase)

POTENTIAL LARGE HEAT LOADS - Sharon Steel

COMMENTS - B&R held meeting with mayor to discuss D.H. Information has been forwarded on D.H. and its benefits. Potential of D.H. is highly dependent on exact location of Resource Recovery Facility.

DISTRICT HEATING
DATA FOR
POTENTIAL SITES

SPRINGFIELD TOWNSHIP

CONTACTS - Robert Giannini, Assistant Township Manager

ADDRESS - 50 Powell Road 19064

TELEPHONE - (215) 544-1300

AREA (SQ. MILES) - 6.2

POTENTIAL HEAT SOURCES - Coal plant (PECo) 5 miles away; Marple Refuse plant (now transfer sta. only); Media Real Estate (215) 565-9000

POTENTIAL LARGE HEAT LOADS - Former Vertol Bldg./Media Real Estate

COMMENTS - District heating existed from 1928 to 1931. Community is now strictly residential. City believes D.H. is not needed in community at this time.

STATE COLLEGE

CONTACTS - Lee Lowry, Acting Director of Public Works

ADDRESS - 118 S. Fraser Street 16801

TELEPHONE NUMBER - (814) 234-7143

AREA (SQ. MILES) - 4.98

POTENTIAL HEAT SOURCES - Penn State Univ. (Oil & Coal Burning)

POTENTIAL LARGE HEAT LOADS - Penn State Univ., John Miller (814) 865-7633

COMMENTS - Penn State studying upgrade of their system. Can investigate tie-in with city, though not probable that university would connect.

DISTRICT HEATING
DATA FOR
POTENTIAL SITES

WILKINSBURG

CONTACTS - E. C. Bauman, Bldg. Inspector & Zoning Officer

ADDRESS - 605 Ross Avenue 15221

TELEPHONE - (412) 244-2927

AREA (SQ. MILES) - 2.25

COMMENTS - Borough is 95% residential, therefore not conducive to D.H. D.H. system existed, abandoned late 1920's.

WILLIAMSPORT

CONTACTS - Mr. Stephen Lucasi, Mayor

ADDRESS - 245 West Fourth Street 17701

TELEPHONE - (717) 326-2831

AREA (SQ. MILES) - 9

POTENTIAL HEAT SOURCES - PP&L

POTENTIAL LARGE HEAT LOADS - Avco Motors, Bethlehem Steel Wire Rope

COMMENTS - May be interested in studying feasibility of D.H. if funds become available.

DISTRICT HEATING
DATA FOR
POTENTIAL SITES

WILLOW GROVE (UPPER MORELAND)

CONTACTS - David A. Dodies, Administrative Assistant

ADDRESS - 117 Park Avenue, Willow Grove, PA 19090

TELEPHONE - (215) 659-3100 x34

AREA (SQ. MILES) - 7.5

POTENTIAL HEAT SOURCES - Barbados Island, Norristown (out of service 2 years ago)

POTENTIAL LARGE HEAT LOADS - Solid State Scientific, Inc.; Alfred Angelo, Inc.; Upper Moreland Twp. School District; Jerrold Electronics Corp., Henry Hope X-Ray Products, Inc.

COMMENTS - City is interested in studying D.H. if funds become available to do so.

REFERENCES

1. Conference Notes, F. Marcazzo (B&R), R. Dornsife (GEC) and City of Chester officials (mayor, planner), representatives of local industry, Potential for District Heating, November 15, 1985.

2. Proposal in response to U.S. Department of Energy Solicitation Number DE-PS01-86OE26546, "Assessing the Potential of District Heating and Cooling in Communities," City of Chester, March 28, 1986.

3. Letter, L. Sommer (City of Altoona) to W. Major (B&R), "City of Altoona, District Heating," March 18, 1986.

4. Letter, D. Jannetta (City of Altoona) to I. Oliker (B&R), "Potential Heat Sources, Altoona," February 19, 1986.

5. Proposal in response to U.S. Department of Energy, Solicitation Number DE-PS01-86OE26546, "Assessing the Potential of District Heating and Cooling in Communities," City of Altoona, March 28, 1986.

6. Letter, G. Cleaver (City of Easton) to I. Oliker (B&R), "District Heating Request for Proposal," February 20, 1986.

7. Telephone Conversation, G. Cleaver (City of Easton) to F. Marcazzo (B&R), Abandoned District Heating System, Easton, December 18, 1985.

8. Letter, G. Cleaver (City of Easton) to F. Marcazzo, "District Heating Survey", December 19, 1985.

9. Proposal in response to U.S. Department of Energy, Solicitation Number DE-PS01-86OE26546, "Assessing the Potential of District Heating and Cooling in Communities," City of Easton, March 28, 1986.

10. Conference Notes, F. Marcazzo (B&R) and J. DeMarinis (Hazleton), Potential for District Heating, December 4, 1985.

11. Conference Notes, R. Buff (B&R) and D. Yoho and D. Lemieux (City of New Castle), District Heating, January 13, 1986.

12. Conference Notes, R. Buff (B&R) and Mayor Price (City of Sharon), "District Heating," January 13, 1986.

13. Telephone Conservation, R. Dornsife (GEC) to F. Marcazzo (B&R), Potential District Heating Sites, Support for Further Study, December 13, 1985.

5.0 DISTRICT HEATING INCENTIVES

5.1 INTRODUCTION

This section identifies a range of incentives that could be used by state and local governments to promote district heating in Pennsylvania. Ultimately all communities should be in a position to make a determination as to whether district heating could operate satisfactorily, not only for economical and environmental reasons but because of the possibility of limited availability of fuel.

5.2 GENERAL DISCUSSION

District heating systems face a number of economic, financial and political problems that impede their ability to develop and grow at a rate comparable to that of conventional systems. Competition with systems utilizing oil or natural gas also hinders district heating development.

Among the impediments that district heating encounters is the lack of public awareness of the benefits which results in a lack of interest and support which is imperative for district heating development within the community.

Credible data is of importance to municipal officials who are often unaware or skeptical about what they may perceive as a new and untried technology. This lack of knowledge and confidence also affects the financial community which imposes high risk penalties on the development of systems.

District heating systems are subject to a variety of federal, state and local taxes that place investor-owned utility systems at a disadvantage relative to other energy supply systems. This could affect a price advantage that district heating may have over conventional heating systems.

District heating systems are often required to obtain a "certificate of public convenience and necessity" which involves paying a franchise tax which is often the method for regulating public utilities. Competitors such as local contractors, who build, install or maintain gas-fired boilers or electrical heat pumps are not required to obtain certificates or pay franchise taxes.

A utility, such as a district heat supplier, is often taxed on both the purchased fuel and the product of the fuel - district heat. Thus multiple taxation may amount to 20 percent of the product's cost, probably rendering the cost for district heat too high to compete with heat generated from conventional systems.

In the past, the Federal government and some states have granted tax credits and other incentives to building owners to encourage energy conservation methods such as the addition of insulation, installation of multiple glazed windows, etc. These incentives were not necessarily extended to the individual building owners who want to modify their building systems to connect to an energy conserving district heating system. Also, individual heating equipment in investor owned buildings qualified for a one-time tax credit, whereas the availability for tax credit on district heating equipment must be determined case by case.

Inconsistent tax policies have slowed the development of district heating. In 1982, the Tax Equity and Fiscal Responsibility Act made district heating projects eligible for tax-exempt industrial development bonds. In 1984, however, Congress placed a limit of $150/capita for each state on tax-exempt industrial, development bonds that a municipal or state agency may sell. Certain high-cost projects were exempted, but not district heating. The general high cost of district heating projects results in its difficulty to compete for the bonds with other non-exempt projects, due to the limit instituted.

Legislation has been introduced in Congress to create tax incentives to promote district heating, yet nothing has been enacted. These incentives include tax-exempt financing, investment tax credits and residential energy credits.

District heating is also hindered by inconsistent regulatory actions. The majority of state public utility commissions within the U.S. specifically regulate district heating systems. Owners of individual heating systems are at an advantage because there are no regulations on such heating systems. When other heating systems are judged against district heating systems, there is a distinct advantage for such individual building systems. It has been found that the most successful district heating systems in the U.S. are those that operate apart from state utility regulation because they are not-for-profit, municipal or institutional installations.

District heating is highly dependent on the use of low-cost, abundant fuels such as coal or municipal solid waste. Local environmental regulations often restrict the use of these fuels for environmental and esthetic concerns. The result may be the loss of the price advantage that district heating would expect over conventional systems that utilize oil or natural gas.

Financial complications also have an effect on district heating systems. The 20-year"take or pay" contracts that are often required from 80% of the potential district heating customers before construction financing can be obtained, do not have a parallel for competitive heating systems installed in buildings. Potential customers may be reluctant to bind themselves to a 20 year contract for district heat, especially when they must pay whether or not they utilize the heat.

Government financing methods used in the past, such as Urban Development Action Grants (UDAG) and Community Development Block Grants (CDBG), have become limited since 1980. Changes in government policies, competition for non-government funding and high interest rates have contributed to the reduction of financing schemes that are available.

5.3 DISTRICT HEATING PROGRAM REVIEW

Two programs described below are designed to promote development of district heating and energy conservation: the New York State District Heating Program, directed by the New York State Energy, Research and Development Authority (NYSERDA), and the program developed following entactment of "Danish Energy Policy 1976."

5.3.1 New York State District Heating Program [1]

Development of district heating is part of NYSERDA's Five Year RD&D (research, development and demonstration) plan. The plan states that the district heating objective is to "Research site-specific feasibility of retrofitting existing power plants and using other heat sources for district heating in urban areas; assist developers of candidate sites in conducting engineering studies and marketing heat to potential users; assist in conducting demonstrations and disseminating results to local government officials and developers." [1]

NYSERDA's goal is to implement district heating throughout New York State. The authority successfully initiated and funded a program in Jamestown, which developed into a 13 MWt hot water district heating system within 2 years. Expansion is planned to bring the peak heat load to around 30 MWt. Other major projects of NYSERDA are planned for Rochester, Buffalo, Rockville Centre, New York City, Roosevelt Island (NYC), and Dunkirk. These projects include evaluation prior to establishment of new systems and reconfiguration and expansion of existing systems.

According to the NYSERDA program, implementation of district heating occurs in three phases:

- o <u>Phase 1</u> - Assess marketing, engineering, economic and financial feasibility, and develop financial commitment from community participants.
- o <u>Phase 2</u> - Continue assessment and develop project to the point where it will be financed.
- o <u>Phase 3</u> - Finance, construct and operate system.

NYSERDA's financial support is most critical in Phase 1 when developing project support is a major concern. Once feasibility is demonstrated, local cost sharing increases substantially for later phases.

The authority's RD&D program is a product of a planning process developed from State energy policy and goals, legislation and regulations. Operating and RD&D revenues come from an assessment levied on the intrastate sales of the State's investor-owned electric and gas utilities, contributions from the New York Power Authority, and funds from technical industries, utilities, universities and the government. Additional revenue is obtained through investment of retained earnings, leased property and fees earned through Industrial Development Bond financing.

5.3.2 Danish Energy Program[2]

District heating developed rapidly in Denmark after World War II. With a readily available supply of heavy fuel oil, district heating provided an economical means to distribute a once inexpensive resource. Government backing in the past through various forms of tax incentives and grant programs encouraged the highly developed infrastructure which exists today. Now, over half of Denmark's primary power plants supply cogenerated district heating, accounting for approximately 14 percent of total heating requirements. By 1995, this figure is expected to be 40 percent through national planning.

Having established an extensive foundation, district heating will expand to supply new areas and will be integrated with other systems to create flexibility through varied energy sources. Plans are being developed to integrate district heating systems across the country in order to utilize surplus heat and a coal-based cogeneration potential, the planning techniques established by a "Heat Supply Act" serve to promote district heating as a viable and essential component in Denmark's energy future.

The Heat Supply Act is a vehicle to plan for Denmark's future energy needs. With the central planning imposed by the act, the future of district heating is guaranteed since as a collective system, it depends on a common goal and authority to insure an economically viable energy solution. Increased use of district heating will hasten independence from foreign oil by establishing a heat supply based on a variety of sources such as surplus heat, cogeneration, natural gas, coal, straw, renewables, etc. Although district heating requires a high initial capital investment, it provides Denmark with flexibility of fuel sources while maintaining a common distribution system. This flexibility is the key to their national energy policy resulting in district heating research, development and construction.

5.4 CONCLUSIONS AND RECOMMENDATIONS

The impediments described previously must be removed in order for district heating to grow and become more competitive with conventional systems. This could not be done by one agency or level of government alone. Change on behalf of the local and state governments is more readily possible and should attract the most attention.

The problem of lack of information on district heating may be easily conquered by state and local governments. Decision-makers at potential sites should be informed of district heating possibilities and the benefits from the technology. Applicable information should be made available to these decision-makers as well as others. Owners of operating systems should be informed of preferred maintenance techniques and equipment as established by existing systems operational experience to improve performance of their systems.

Creation of a district heating committee is suggested to assist in sustaining and promoting district heating in Pennsylvania. This committee would consist of members from the Governor's Energy Council (GEC), the Pennsylvania Energy Development Authority (PEDA) and other persons with district heating experience who could provide technical insight. The committee could become a branch of the GEC or PEDA, model itself after NYSERDA or others and develop a district heating program for the Commonwealth. Funding would be required to support district heating studies and projects under the jurisdiction of the committee.

Specific functions of the committee would be to:

- Maintain channels of information, defining district heating and its benefits and reporting on the status of district heating in Pennsylvania.
- Review current district heating situations, and make recommendations.
- Select district heating projects most deserving of funds.
- Conduct meetings and/or seminars to dispense information related to district heating.

Consistent tax policies and regulation is necessary for district heating's development. District heating should be treated on an equal level with conventional systems. District heating systems should be extended the benefits that conventional systems encounter, such as tax credits for energy conservation that are granted by government agencies when installing energy saving devices. Taxes on both fuel and product should be removed when they do exist. This is inconsistent with the fact that conventional systems have no taxation on the energy produced from these units as district heating systems do.

An attempt should be made to expand financing methods to encourage district heating growth. The limit on tax-exempt bonding has slowed progress in the district heating field.

District heating may be categorized along with other capital-intensive projects that have been exempted from the $150/capita limit for industrial development bonds. This along with the availability of investment tax credits and other favorable tax policies, may spur the growth of district heating systems.

Financial assistance from a state level would be helpful for performing feasibility studies, for prospective new systems, or even for operating systems considering improvements. For example, conversion from steam to a hot water system involves heavy expenses but results in a more efficient system. Replacement of old steam piping is also costly but important. Conversions to less expensive fuel or incorporation of cogeneration are study projects that could be funded.

Should an operating system consider major equipment modifications or additions in order to improve system performance, the State could offer tax incentives for the capital investment. These can take the form of income tax deductions, property tax deductions or exemptions for certain forms of real property, and tax credits.(3) These incentives can also be offered for new construction.

Low or no-interest loans can be arranged for district heating projects particularly when a district heating organization has difficulty obtaining commercial financing. A State agency can acquire funds for the loans through direct appropriations, special tax levies or federal assistance.(3)

Funds for district heating feasibility studies can be made available by a state organization like the GEC alone or with the U.S. DOE, and/or U.S. HUD.

In brief, the following steps are recommended to the GEC or other State agencies for the purpose of promoting district heating in Pennsylvania:

- o Establish a district heating program aimed at maintaining the present district heating systems in Pennsylvania, and promoting future district heating projects.
- o Form a district heating committee to work on district heating activities.
- o Develop a budget for funding projects related to district heating. These could include feasibility studies and subsequent phases as well as projects directed towards improving performance of currently operating systems (e.g. fuel conversions, steam to hot water conversions, and incorporation of cogeneration).
- o Work towards improving tax policies by promoting provisions for tax incentives, revenue bonds, or low or no-interest loans for district heating systems.
- o Eliminate any inconsistencies in regulations for district heating and conventional systems.

District heating has potential for conserving our valuable energy resources, as observed from the success of the many systems incorporated in the U.S. and abroad. These systems developed under the guidance of such programs as NYSERDA and the Danish Energy Program, show benefits in the areas of fuel conservation and community development and revitalization.

Pennsylvania should follow these examples in order to develop a district heating program that would work for the citizens of the Commonwealth by becoming more energy self reliant.

District heating activity in Pennsylvania is picking up as can be seen by the coal-based cogeneration projects emerging at Franklin and Marshall College in Lancaster; the State Correctional Institute at Frackville; and the joint effort by Amtrak and the University of Pennsylvania in Philadelphia. A statewide district heating program used as guidance for these and other developing projects, would benefit and promote the district heating situation in the State. Encouraging the use of Pennsylvania's natural resource material, coal, in conjunction with the institution of district heating would bring forth economic benefits for citizens of Pennsylvania and the Commonwealth itself, by creating jobs and reducing costs through the conservation of valuable energy.

REFERENCES

1. Strnisa, F., "New York State District Heating Program", presented at the International District Heating and Cooling Conference, Minneapolis, Minn., June, 1985.

2. Energy in Denmark, Ministry of Energy, December, 1984.

3. Leighton, G., "Financing Community Energy Projects", Shippensburg University, 1985.